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Author(s): Andrew Barker

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Aristotle on Perception and Ratios

ANDREW BARKER

At several points in the argument beginning at *De Anima* 424a17, Aristotle describes αἴσθησις as a λόγος. This description has generally, and I think rightly, been taken to involve the sense of λόγος as ‘ratio’, and it has been understood as being related to his earlier thesis (424a2 ff.) that αἴσθησις is a μεσότης, a mean between sensible extremes. Αἴσθησις, in this context, is the faculty or capacity of perception, rather than the activity that goes on when we actually perceive: it is that by which we judge αἰσθητά, not the act of judging or apprehending them (424a5-6); it is given a description jointly with τὸ αἰσθητικῶ εἶναι, ‘what it is to be capable of perceiving’ (26-28); and the description itself is comprised in the words λόγος τις καὶ δύναμις.

Two kinds of object, according to these passages, escape our perception, for quite distinct reasons. We do not perceive (οὐκ αἰσθανόμεθα) what is ὁμοίως θερμοῦ καὶ ψυχροῦ, ἢ σκληροῦ καὶ μαλακοῦ (424a2-3): that is, apparently, we do not perceive e.g. the hotness or coldness of something that is itself at the same temperature as our sense-organ. Secondly, our αἴσθησις is destroyed, because the λόγος constituting it is destroyed (λύεται), by excesses in the objects of perception, ‘just as the concord (συμφωνία) and pitch (τόνος) of the strings is destroyed when they are struck too vigorously’ (28-32). The first of these remarks suggests that we perceive through comparison or contrast: we judge or measure the relation between the condition of our sense-organ and the condition presented to us. The second, though its details are controversial, indicates that the properly balanced condition of our sense organs (αἰσθητήρια) may be disturbed by an excessive stimulus, to such an extent that they cease to function.

There are many difficulties in these doctrines and their elaborations elsewhere, but it is not my intention to pursue them. My much more limited aim is to consider, against the background of these sketchily indicated ideas, a passage in *De Anima* III which has commonly been treated as echoing them. I shall try to show that it does nothing of the sort: that unlike the passages I have cited it makes no general claims about the nature of αἴσθησις at all, and none about αἴσθησις considered as a faculty; that it deals only with instances of actualised perception, and those only of one very specific kind; and that the variety of λόγος with which it is concerned is radically different.

The argument to be considered appears at 426a27-b7. In the version printed in Ross's O.C.T. it begins as follows.

εἰ δ' ἡ φωνὴ συμφωνία τις ἔστιν, ἡ δὲ φωνὴ καὶ ἡ ἀκοὴ ἔστιν ὡς ἓν ἐστὶ [καὶ ἔστιν ὡς οὐχ ἓν τὸ αὐτό], λόγος δ' ἡ συμφωνία, ἀνάγκη καὶ τὴν ἀκοὴν λόγον τινὰ εἶναι.

If voice is a kind of concord, and voice and hearing in a way are one [and in a way the same thing is not one], and if concord is a ratio, then hearing must also be a kind of ratio (a27-30).

The order of words in the first clause is a matter of some doubt. What Ross prints is given in Priscian and Sophonias, but the MSS unanimously reverse the order of the words φωνὴ and συμφωνία, producing as the first premise 'If concord is a kind of voice'. I shall discuss the issues involved below. The passage continues:

καὶ διὰ τοῦτο καὶ φθείρει ἕκαστον ὑπερβάλλον, καὶ τὸ ὀξύ καὶ τὸ βαρὺ, τὴν ἀκοὴν· ὁμοίως δὲ καὶ ἐν χυμοῖς τὴν γεῦσιν, καὶ ἐν χρώμασι τὴν ὄψιν τὸ σφόδρα λαμπρὸν ἢ Ἰοφερόν, καὶ ἐν ὀσφρήσει ἡ ἰσχυρὰ ὀσμὴ, καὶ γλυκεῖα καὶ πικρά, ὡς λόγου τινὸς ὄντος τῆς αἰσθήσεως. διὸ καὶ ἡδέα μὲν, ὅταν εἰλικρινῇ καὶ ἀμιγῇ ὄντα ἄγεται εἰς τὸν λόγον, οἷον τὸ ὀξύ ἢ γλυκὺ ἢ ἄλμυρόν, ἡδέα γὰρ τότε· ὅλως δὲ μᾶλλον τὸ μικτόν, συμφωνία, ἢ τὸ ὀξύ ἢ τὸ βαρὺ [ἀφ' ἧ δὲ τὸ θερμαντὸν ἢ ψυκτόν]. ἡ δ' αἰσθησις ὁ λόγος· ὑπερβάλλοντα δὲ λύει ἢ φθείρει.

This is why each thing in excess, both in the high and the low, destroys the hearing: and similarly in flavours excess destroys taste, in colours the intensely bright or dark destroys sight, and in smelling a powerful smell, whether sweet or bitter, (destroys smell), since the perception is a kind of ratio. This is also why things are pleasant when they are brought pure and unmixed into the ratio, for instance the high or the sweet or the salty, for they are indeed pleasant then; but in general what is mixed is more pleasant, a concord more pleasant than the high or the low [and for the sense of touch that which can be further heated or cooled is more pleasant]. The perception is the ratio; and things in excess dissolve or destroy it. (a30-b7).

The close similarity between the language of this passage and that of 424a, and between the examples used in each, makes it hard to resist the initial assumption that the substance of what they are saying is broadly the same. I shall try to show that this assumption cannot coherently be sustained.

Of the three premisses of the argument set out in the first sentence, the second and third are relatively unproblematical. The statement that the voice and the hearing (the actualisation of both in the same instance of

hearing and sound) are ‘in a way’ one simply repeats the doctrine of the passage immediately preceding the present paragraph. (See particularly 425b26, 426a15). The statement that συμφωνία (in the sense ‘musical concord’) is a λόγος is a commonplace of mathematical harmonics, repeated by Aristotle at e.g. *An.Post.* 90a19, cf. *Phys.* 195a29, *De Sensu* 439b25-440a3. But the first premise presents serious difficulties.

According to Ross¹ and Hamlyn², the first sentence can be construed as a valid argument only if we adopt, in the initial premise, the order of words given in the O.C.T. Both of them acknowledge, however, that it is then not easy to see how the first premise is itself to be understood, and how the hypothesis it puts forward might plausibly be justified. The alternative word-order generates a hypothesis whose justification seems closer to hand, even if its sense still needs some elucidation, but – so it is alleged – its adoption as a premise will make the argument of which it is a part formally invalid. The issue between the two readings is of some importance in establishing the sense of the passage as a whole. Let us consider first the O.C.T. version.

There are three major questions to be answered. First, what does the premise mean, and how is the hypothesis it expresses to be justified? Secondly, does it in fact enable the conclusion, as understood by Ross and Hamlyn, to be validly derived? Thirdly, can the conclusion that it generates support the reasoning of the remainder of the passage?

The thesis is that φωνή is a kind of συμφωνία. According to Ross, φωνή is to be understood in its usual sense as ‘the human voice’. But why should it be called a συμφωνία? Ross points out that Aristotle often insists on a distinction between φωνή in this sense and sound of other kinds, which can generically be labelled ψόφος. He cites a number of passages in support of this claim, and it is undoubtedly correct. But none of the distinctions suggested by the passages he cites appears to have any relevance to the description of the human voice as a συμφωνία. Further, even if they did, the conclusion of the argument, as Ross understands it, is that *every* ἀκοή is a λόγος. But the human voice is not the only object of hearing; we also hear ψόφοι; and the argument cannot support the conclusion that ἀκοή is a λόγος in cases where its object is not a φωνή. Hence if the conclusion is general, the argument, on this interpretation, is invalid.

Hamlyn’s account of the matter is rather subtler. He suggests, first of all, that φωναί are pitched tones. This is plausible enough, and could be supported by the usage of the music theorists, for whom φωνή often means simply ‘musical sound’, whether that of the singing voice or of an instrument. (See e.g. Aristoxenus *El.Harm.* 14.3-4, 28.23, 48.30.) He goes on to

argue that in Aristotle's view just as colours (other than white and black) are mixtures of white and black in some λόγος, so also pitched tones are mixtures of high and low. He recognises the fact that since not everything heard is a pitched tone, his version of the argument is open to the same accusation of invalidity as is Ross's; for he too understands the conclusion as stating that every ἀκοή is a λόγος. He seeks to avoid this difficulty by arguing that it is when its objects are pitched tones that hearing functions most completely and adequately: that these tones are, as it were, the paradigm objects of hearing, and that 'when the sound has uncertain and indefinite pitch there is similar indefiniteness and uncertainty in hearing.' Hence general conclusions about hearing can be drawn from truths about hearing pitched tones: other cases of hearing are both parasitic and defective.

In stating that pitched tones, like colours, are mixtures in some ratio, Hamlyn is relying on *De Sensu* 439b19 ff and 447a29 ff; but I think he has misconstrued what these passages say. It is true that Aristotle takes intermediate colours to be mixtures, and the pleasant ones among them to conform to simple ratios, and that he uses the analogy of the simple ratios of concords to underwrite this conception. It is true also that he conceives the perception of a concord as the perception of something unitary, a true mixture in which the individual characters of the two constituent notes disappear, and which constitutes a single sound distinct from either of them. But this does not mean that he takes the sound of a concord to be the sound of a single note or pitch (φθόγγος or τόνος), still less that hearing *any* pitched note is hearing a concord, or something analysable as a mixture of high and low. On the contrary, his description of a concord as something unitary merely reflects the commonest of the definitions of musical concord given by the Greek theorists.³ Concords are combinations of a higher and a lower pitch, blended into a single unity. Similarly, according to Aristotle, colours other than black and white are mixtures of these extremes, and the pleasanter ones, like the pleasanter combinations of sounds, are those involving ratios of an especially simple kind. But this does not mean that intermediate sounds, like 'intermediate' colours, are blends of high and low. A concord is not a note of medium pitch. It is a ratio between relatively high and low notes, but it will be the very same ratio, and hence will be of the same relevant quality, whether its bounding notes are themselves high, low, or intermediate. Nor can we suppose that in the *De Sensu* Aristotle is using the word συμφωνία, anomalously, to mean 'pitched tone'. His argument depends on the *assumption* that συμφωνίαι are ratios, an assumption standardly made by the more mathematically

mindful theorists in relation to concords, but by no one, so far as I am aware, in relation to single notes. The normality of his use of the word συμφωνία is emphasised by his reference to the special ratios 3:2 and 4:3, which are the ones standardly assigned to the two smallest and most fundamental concords recognised by the Greeks, the fifth and the fourth.

Again, in a mixture the separate constituents disappear. But before these elements are blended, they are perceptible in their own characters. Black and white are perceptible, and they are not mixtures. Pure tones are also perceptible; and if they are alleged to be mixtures none the less, we are bound to ask what they are mixtures of: a regress evidently threatens. Besides, it is made quite clear in our present passage that such tones are not mixtures. Aristotle *contrasts* the perception of mixtures with the perception of things that are not mixed, and his main example of the former is συμφωνία, of the latter the high and the low (426b3-6). It follows that even if we accepted Hamlyn's contention that the best and clearest cases of hearing are those in which we hear pitched tones, this would have no tendency to support the thesis that συμφωνίαι or mixtures are the paradigm objects of hearing. The notion that pitched tones are mixtures has no basis in the text, where it is in fact implicitly contradicted. Hence even if a justification for the first premise could be found, on the lines that Hamlyn suggests, the argument as a whole would remain invalid, so long as we take its conclusion to be that every ἀκοή is a λόγος. It will have done nothing to show that ratios are involved in the hearing either of pure tones or of mere noises.

It has generally been assumed, as it is by both Hamlyn and Ross, that the present passage reflects the doctrine of 424a that the faculty of perception, or each specific faculty of perception, is itself a λόγος. If we now raise our sights to consider the passage as a whole, we shall find that this assumption cannot coherently be upheld. Three points are worth particular attention.

Let us imagine, first, that a suitable justification could be found for Hamlyn's or Ross's interpretation of the initial premise that we have been discussing, and for the contention that the argument validly generates the conclusion that every ἀκοή is a λόγος. The initial premise will still depend on some very special doctrine about the nature of sounds. Hence, if Aristotle wants to extend his conclusion about ἀκοή to other forms of αἰσθήσεις as well, similar special doctrines will be needed in the case of each of them. No such doctrines are in fact expressed or suggested, and yet Aristotle immediately treats the other αἰσθήσεις as though what has been said of ἀκοή can plainly be said of them too. Thus the usual interpretation requires us to suppose that Aristotle has moved from a conclusion that was limited, by the highly specific character of its first premise, to the sphere of

hearing, to extend it without warrant to the sphere of αἰσθησις in general. The extension is analogous to his previous apparent shift from a premise about hearing φωναί to a conclusion about ἀκοή in general, and it is at least as inadequately based.

Secondly, if we admit the conclusion of the first argument as saying that every ἀκοή is a λόγος, this conclusion cannot be regarded as established by the argument to which it belongs, even on the most generous interpretation, unless we understand the term ἀκοή in one quite specific way. The argument depends on the premise that the object of ἀκοή is a λόγος, and that ἀκοή and its object are 'in a way one'. What that way is is clearly explained in the preceding passage, where we are told that it is the actual perceiving and the actual sounding that are one: the *capacity* for perceiving is another matter altogether (425b26ff, 426a15ff). There is nothing to suggest that the capacity or faculty is itself identical with the object in any way at all. Hence the conclusion that ἀκοή is a λόγος has to be taken in a radically different sense from the general doctrine of 424a, where the αἰσθησις described as a λόγος is the faculty or potential. Aristotle may, of course, still hold the view stated in 424a, but it is patently not the one proved here; and unless we are to accuse him of ignoring distinctions that he has been at some pains to establish, neither the λόγος nor the αἰσθησις of the present passage can be the same as those of the earlier one.⁴

Thirdly, if the doctrine underlying our present argument is that all αἰσθησις, in some sense or other, is a λόγος, Aristotle might be supposed to have some grounds for asserting that the perception of any 'mixed' object whose elements stand to one another in some ratio is pleasanter than the perception of any 'pure' object. His remarks at the end of our passage have been understood in this sense; but as I shall show later, this interpretation cannot be sustained, and the position would in any case be a very strange one. Quite apart from what he actually says here, Aristotle would be unlikely to hold that every mixed percept is thereby pleasanter than every unmixed one. Many discords have perfectly whole-number ratios (as was well known: in Greek theory all superpartient ratios, and all superparticular ratios smaller than 4:3, counted as discords, and any such ratio below about 8:7 sounds as a discord even to most modern ears). Two *auloi* sounded a semitone apart can be presumed to sound less ἡδύ than a single *aulos* uttering a pure pitch. Not just *any* mixture of tastes is pleasanter than every pure taste. But if some pure percepts are pleasanter than some mixtures, neither the doctrine of 424a, that the faculty of perception is a λόγος, nor the thesis that every actual occasion of perception involves a λόγος, which might, on a generous view, be extracted from the present

passage, can be used to explain, by itself, the fact that *some* mixtures are pleasanter than some or all pure percepts. I conclude, then, that the doctrine of 424a is neither proved nor used in the present passage, and that the slogan 'αἴσθησις is a λόγος' has been used in these two different places, to the confusion of Aristotle's readers, in two quite different senses.

In order to develop a more satisfactory approach to the passage we must begin again from the first premise of the opening argument. In view of the difficulties thrown up by the order of words adopted in the O.C.T., it is worth reconsidering the alternative order which appears in the MSS. This gives the clause εἰ δ' ἡ συμφωνία φωνῇ τίς ἐστιν. Before investigating the credentials of the argument which it yields, its own sense needs to be established.

The thesis that συμφωνία is a kind of φωνή is patently absurd if συμφωνία means 'musical concord', and φωνή means 'human voice'. There can, however, be no doubt that this is the correct sense of συμφωνία, since otherwise the assumption that συμφωνία is a λόγος will be without foundation. Since not all concords are produced by the human voice, we must find some other way of understanding φωνή, and we have already seen that it is commonly used in the sense 'musical sound', without prejudice as to whether it is vocal or instrumental. φωνή is probably, in fact, the best term available in the present context. Alternative words, such as φθόγγος and τόνος, do not mean 'musical sound' *simpliciter*, but 'note' or 'pitch'. A concord is a musical sound, but it is not a single note or pitch.

On this interpretation the first premise makes unobjectionable sense, and it may have a further point. When we hear a concord we hear a sound: we do not hear two distinct sounds. Hence concords are objects of hearing in their own right, and are not merely conjunctions of two distinct objects of hearing. This attitude to concords, which as we have seen is explicit in the *De Sensu* and common among the Greek musical theorists, is undoubtedly presupposed by the remainder of the argument, on any interpretation. If hearing a concord is merely hearing one sound and hearing another, there can be no basis at all for the assertion that the ἀκοή is a λόγος: there would be two distinct (and therefore, according to the *De Sensu*, successive, not simultaneous) ἀκοαί, which might indeed be said to stand in some ratio to one another, but neither of which would itself be a ratio. If Aristotle's intention was to emphasise the fact that a concord is one sound, one object of hearing, and not two, he might have done better to say so explicitly, perhaps by inserting the word μία. But the clause can, I think, carry this sense as it stands: and if it cannot, its meaning is unproblematic, if rather trivial. A concord is a musical sound: either this directly states that

it is a *single* musical sound, or else the unity of a concord is simply assumed before we begin.

In isolation, then, the clause gives no serious difficulty. We must now consider the argument of which it is a premise. It will run as follows:

- (i) A concord is a musical sound.
- (ii) The musical sound and the ἀκοή are in a way one.
- (iii) A concord is a ratio.

Hence

- (iv) The ἀκοή must necessarily be a ratio.

This argument has been treated as invalid both by Ross and by Hamlyn. So it is, if the conclusion is that ἀκοή as such, every ἀκοή, is a ratio. Several commentators, including Brentano⁵ and Beare⁶, have adopted the version of the first premise that we are now proposing, but both of them wish also the construe the conclusion universally, as referring to every ἀκοή. Beare (p. 117) seems not to notice the difficulty. Brentano (p. 66) seeks to avoid it through a manoeuvre similar to Hamlyn's, asserting that συμφωνία is the paradigmatic object of hearing, and that conclusions about all hearing may therefore be drawn on the basis of what is true of hearing συμφωνίαι. But his grounds for the paradigmatic status of συμφωνία are weak; and even if they were not, it is clear that in the latter part of this passage Aristotle is treating our hearing of pure tones, high or low, not as defective instances of hearing concords, but as diametrically contrasted with hearing concords. Brentano's interpretation is open, in fact, to most of the criticisms that we have directed at Hamlyn's.

But the argument may be construed in a different way. Premise (ii) does not say that *every* sound and the related ἀκοή are one, though this is indisputably Aristotelian doctrine, established in the preceding passage. It says that the φωνή, the musical sound mentioned in (i), and *its* ἀκοή are one. Then the conclusion generated by the three premisses cannot be that *every* ἀκοή is a ratio: it can only be

- (iv) The ἀκοή referred to in (i) must be a ratio.

That is, the conclusion is not that all ἀκοαί are λόγοι (still less, as the usual interpretation of the passage seems to demand, is it something implying that all αἰσθησεις are λόγοι), but only the limited doctrine that when we apprehend with our hearing something that is itself a λόγος, our hearing is (receives the form of) that λόγος. This thesis is unstartling, given the argument of 425b26 ff. Moreover, unlike the conclusion usually adopted, this one can obviously be extended without further ado to the other senses. Whenever *they* perceive things that are λόγοι (as are e.g. colours other than white and black), they themselves are λόγοι. This follows straightforwardly

from Aristotle's general doctrine about the quasi-identity of perception and percept: hearing is just a special case, used for ready illustration: whereas if we take the opening argument as a special proof of the doctrine that every ἀκοή is a λόγος, depending on the (odd) thesis that every φωνή is a συμφωνία, then we shall need, and do not get, special proofs referring to the other senses as well.

We can therefore accept the revised first premise, and the argument to which it contributes, if we do not suppose that Aristotle is arguing for the general view that every case of hearing is a λόγος (and then gratuitously extending this thesis to the other senses), but take him only to be showing, relatively uncontroversially, that when we hear a concord, or anything else that is itself a ratio, our hearing constitutes a ratio. We no longer need Hamlyn's (or Brentano's) rather unconvincing argument that one special kind of audible object counts as a paradigm, and that other kinds, which cannot be analysed in the same way (as mixtures or ratios), must be understood as defective examples of the same sort of thing. More importantly, we need find no oddity in the fact – inexplicable, it seems to me, on the usual view – that Aristotle makes no use of his alleged equation of *actualised* αἴσθησις and λόγος anywhere in the subsequent discussion, or indeed elsewhere, so far as I know. If he believed that the actualisation of perception always involves the reception of a ratio, and if he thought that he had proved it, he would have an important doctrine that could hardly avoid affecting his treatment of the senses in other contexts. I can detect no such influence, only that of the quite different doctrine, established in 424a, that the faculty or capacity for perceiving is in some sense a λόγος or μεσότης. Aristotle's failure to make any use of the thesis that actualised perception is a ratio strongly suggests that he did not take himself to have proved it, and that most probably he did not believe it.

The interpretation I am proposing cannot stand unless it can provide a consistent way of reading the rest of the passage, down to 426b7: and there are difficulties.

426a30-b4 has standardly been taken to mean that an excess of one extreme or another (where the extremes are height and depth of pitch, brightness and darkness of colour, sweetness and bitterness of smell) destroy the capacity for perception; and that this is because, since perception involves (in some way or another) a ratio, the overwhelming excess of one extreme so unbalances the proportions that the ratio itself is destroyed. It is, on this view, the capacity or faculty of perception that is impaired, and the passage is closely parallel to 424a28-32.

This interpretation works badly, for several reasons. In the first place, as

I have argued, the most that Aristotle could be taken to have shown here is that an instance of perception involves the reception of a ratio. He cannot on any reading be taken to have shown, in the present passage, that the capacity for perceiving is a ratio; and the structure of the passage is such that the whole of its latter part must hang on what he takes himself to have proved in the first sentence, not on something set out in the previous book. Hence the destruction of the λόγος, whatever that means, cannot be identical with the destruction of the capacity for perceiving, whether this destruction is total and permanent, or, as Hamlyn more plausibly suggests, merely temporary (in normal cases). It ought, apparently, to mean the destruction of the present instance or actualisation of perception. But this is a difficult notion to interpret, particularly if, as most of the commentators seem to think, the destructive feature of what is perceived is its proximity to an extreme, such as high pitch. If we take the concord of a fourth, at any random pitch, the ratio between its elements, as Aristotle well knew, remains 4:3. No matter how high or low the individual notes may be, so long as they constitute a fourth, the ratio is unchanged. How then is the λόγος destroyed? If, on the other hand, we move e.g. just the higher of the two notes upwards, certainly the λόγος, and our perception of it, is destroyed, but only in the sense that we are no longer hearing the concord heard previously. Our perception has altered, along with its object: but Aristotle's talk of 'excess' and 'destruction' makes it clear that he has something a good deal more radical in mind.

Secondly, the thesis that extremes on the various sensory scales make us incapable, in any sense, of perceiving, is thoroughly bizarre. A case might be made, superficially, in relation to hearing, since there are pitches above and below which we do not hear: but again, to say that these pitches 'destroy the hearing' would be at best hyperbole. We simply do not hear them, and our hearing is in no acceptable sense destroyed whenever a bat squeaks overhead. In relation to the other kinds of perception, the doctrine is still less plausible. The extremes of colour, according to the *De Sensu*, are white and black: but we perceive them without difficulty or discomfort. And while we may concede that bitter tastes or pungent smells affect us in a way that is not only unpleasant but genuinely disturbing and disruptive, the same can scarcely be said of sweet smells and tastes.

My hypothesis will demand that τὴν ἀκοήν at 426a31 does not mean 'hearing' generally, but 'the hearing we have been talking about', namely the hearing of a concord, a case of hearing that corresponds to, and consists in, a ratio. Such cases of hearing, we are told, are destroyed by excess either of high or of low. We are faced with the double difficulty of deciding what

is meant by the destruction of an *instance* of hearing, rather than of the capacity for it, and of determining what feature of the object it is that has this destructive power. 'Excess of the high or the low', once again, can hardly mean 'excessively high or low pitch', since the nature of the concord, and its ratio, is not affected by the absolute pitch of its constituent notes.

The solution to this problem must be that the excess is not excess of height or depth, but excessive volume, attached to either the high or the low note. This accords well with an earlier passage where what 'destroys perception' is the μέγας ψόφος, not the very high or low one (422a24): and it may also be what is intended at 424a28-32, where the κίνησις of the sensible object is described as ἰσχυρότερα. It also fits well with the description Aristotle gives in our present passage of 'excess' in the other sense-ranges. τὸ σφόδρα λαμπρὸν ἢ ζοφερόν is not the absolutely white or black, but the very brilliant or dark (shadowy). The excess is of brightness or darkness, to do with luminosity, not hue. Similarly he designates the destructive kind of smell not as excessively bitter or sweet, but as 'strong' (ἰσχυρά), whether sweet or bitter'.

As to what is meant by the destruction of an instance of perception, we can construe what he means for each sensory dimension as follows. In the sphere of hearing, two notes form a concord if they stand in one or another of a small and specifiable number of ratios (the fundamental ones being 2:1, 3:2, 4:3). But our hearing of such a concord is destroyed if either note is excessively loud. We then no longer hear the concord, only the single note: the other is swamped. Thus our hearing of the sort of φωνή constituted by a concord depends not only on the ratio of the notes, considered as pitches, but also on their (very approximate) equality in point of volume. (Cf. *De Sensu* 447b5-6, where it is clear that the respect in which κινήσεις must be equal in order to avoid the obliteration of one by the other is not the same as that in which the notes in a concord must stand in a specific ratio. This ratio is never equality, which would generate unison (ὁμοφωνία), not concord. In the case of sounds, if the equality does not hold between them in their character as pitches, it can hardly be supposed to hold of anything but volumes). Thus when one note or the other is too loud, the concord, along with its ratio, still persists, but our perception of it is destroyed: we are unable to hear it.

In the case of colours, according to the position of the *De Sensu*, a colour such as blue is a mixture of white and black in a certain ratio. But blue may be brilliant or dark, and well or badly illuminated, and if a surface is too brilliant (shiny?) or too shadowy, it may be impossible to tell what colour it is, even though the ratio of white to black persists. In the case of tastes and

smells, quality (sweetness or bitterness) is distinct from intensity, and our discrimination of the unified product of a given blend may be ‘destroyed’ by the excessive intensity of either element. A thing may be very bitter or very sweet without having great intensity of flavour. Then if the ‘ratio’ of a blend of a particular type is thought to be determined by the relative quantities of ‘the bitter’ and ‘the sweet’, this ratio can persist, but become undetectable to our sense of taste, if the intensity of one element is excessive. (Thus if we posit, perhaps artificially, a single scale from sweet to sour, we must treat lemon juice diluted with water, unlike sugared lemon juice, as no less sour – i.e. no sweeter – than pure lemon juice. It is merely less intense, analogously to a note being less loud. But the use of pure lemon juice in a mixture where diluted lemon juice would be appropriate may swamp the flavour of the other element, so that though the ratio of sweetness to sourness is unaltered, the sourness of the lemon juice, because of its excessive intensity, is all that we perceive.)

It is then at least possible to interpret 426a30-b3 in a way that conforms to the interpretation I am offering. Aristotle begins by talking about the ἀκοή that was identified in the first sentence, the ἀκοή of a concord. This ἀκοή is destroyed, though the ratio inherent in the object is not, if one or other of the notes is too loud. He then goes on to add that the same thing is true in the case of tastes, sights and smells, ‘since the perception is a ratio’ (ὡς λόγου τινὸς ὄντος τῆς αἰσθήσεως). That is, not ‘because perception *in general* is a ratio’ (which in the sense given to it at 424a is a view that Aristotle holds, but is irrelevant here, and in its alternative sense is a view that he probably does not hold, and certainly has not established), but ‘because the perception in question, the perception by these senses of things analogous to concords, is a ratio’. This perception is destroyed, though in an important sense its object still exists, if the ratio becomes undetectable due to the predominance of the element which corresponds to one or other of its terms.

The most serious difficulty comes with the group of sentences that completes the passage, and particularly with its first part (426b3-5). It apparently means ‘This is why things are pleasant (ἡδέα) even when they are brought pure and unmixed into the ratio (ἄγεται εἰς τὸν λόγον) – things like the high or the sweet or the salty –; for they are indeed pleasant then, but...’ (Aristotle does not of course suppose himself to have explained why things are pleasant even when pure. As the continuation shows, he has explained why, while they are pleasant when pure, they are more pleasant when mixed). The main puzzle lies in the clause ‘when they are brought pure and unmixed into the ratio’.

The clause provides problems even for the traditional interpretation. Something pure and unmixed cannot itself be a ratio, since the ratios are always ratios of elements in a mixture. The category of the mixed is exemplified at 426b6 by συμφωνία, which is therefore being contrasted with the εἰλικρινῇ καὶ ἀμιγῇ: these are plainly not συμφωνίαι. But if the first sentence is taken to prove that every ἀκοή is a λόγος, on the grounds that the object of every ἀκοή is a συμφωνία, pure and unmixed sounds should not be audible at all, let alone pleasant, as they are admitted to be.

The problem for my interpretation is different. If the λόγος of 426b4 is still, as I am bound to argue, the ratio constituting the condition of our perception when we are in the act of hearing something mixed, what can be meant by the introduction to this ratio of something pure and unmixed? It would be pusillanimous to suggest that Aristotle has slipped up, and written τὸν λόγον where τήν αἴσθησιν would have been more apt: besides, we need, I think, to treat τὸν λόγον here as the reference of ὁ λόγος in 426b7. I am arguing that the ratios referred to in this passage are always either the ratios between the elements of something perceived, or the ratios imposed on our perception, at the time it is active, by its assimilation to the form of such an object. In either case the object must be analysable into several elements (at least in theory): it cannot be described as εἰλικρινής and contrasted with an object that is 'mixed'.

Once again, the *De Sensu*, together with some ideas current among the musical theorists, may help to resolve the difficulty. In the *De Sensu* Aristotle suggests that while conjunctions of sensibles may sometimes form a mixture and be perceived as a unity, this is not invariably the case (447a29-b21, particularly b16). In the sphere of hearing, the mixtures that constitute coordinated unities are referred to as συμφωνίαι (447b2). Among the musical theorists it is usual to distinguish discords from concords by saying that the latter form a single, unitary blend, in which neither element is distinguishable as such, whereas in the former the two notes involved continue to be heard as distinct items, and do not generate a new *tertium quid*.⁷ It is likely, I think, that this is the idea that Aristotle has in mind here. Cases where we are presented with more than one sound fall into two classes. There are those where the discrete elements are blended into a single new sound, a concord; and there are those where they are not, but remain separately what they would be if they had been sounded singly. They are 'brought into the ratio', because a ratio is bound to be involved when notes of more than one pitch are sounded together. They enter the ratio 'pure and unmixed', because they do not blend together. It might be objected that if Aristotle were really talking of discords, he would be

unlikely to call them even qualifiedly 'pleasant'. That is true; but it is not discords that he is describing in this way. It is the discrete elements that enter into discords, each considered as heard separately from the other term of the ratio. When sounds of definite pitch occur at the same time, they remain pure and unmixed, so far as our hearing of them is concerned, unless they jointly constitute a concord. There is no reason why they should not therefore remain, individually, as pleasant as they would be if they were sounded and heard in total isolation.

Aristotle is not arguing, then, that combinations of sounds are always pleasanter than pure sounds, and it is unlikely that he would have thought that they were. He is arguing that when we hear sounds in combination, the effect is pleasanter when the sounds are 'mixed', and form a unity, than it is when they are unblended: or, more precisely, that the unified mixture is more pleasant than either member of a pair of unblended sounds, when such a member is heard together with the other member, but forms no mixture or unity with it. This can be understood as a way of saying that concords are pleasanter than discords, since according to the standard view of the musical theorists, hearing a discord precisely is hearing two notes separately, each in its own unaltered character. (Cf. also ps.-Ar. *Problems* 921a3-7, the argument of which can, I think, be construed in a very similar way.)

If this is correct, the passage does not contrast αἰσθήσεις that are constituted by ratios with those that are not so constituted, nor does it involve the doctrine that all αἰσθήσεις without exception are so constituted. It deals throughout only with that special class of αἰσθήσεις whose members are constituted by ratios, and whose existence he has proved in the first sentence. He has not set himself the task of explaining why hearing ratios is pleasanter than hearing pure tones: as we have seen, since discords are ratios, he cannot have supposed that this alleged explanandum is, in general terms (ὅλως), true at all. What is to be explained is why one kind of ratio has a pleasanter effect than another. (The task is close to that offered by Plato to the Pythagoreans at *Rep.* 531c3-4, and undertaken, though in very vague terms, by the author of the Introduction to the Euclidean *Sectio Canonis*. But while these authors understand the problem as belonging to pure mathematics, and as capable of being resolved by a mathematical specification of the difference in kind between one class of ratios and another, Aristotle, characteristically, takes it to be a problem about the psychology of perception, about what happens in us when we encounter each of the two kinds of perceived combination.⁸)

What, then, is Aristotle's explanation? He begins from the thesis that the

perception of a combination of objects within one sensory range must constitute a ratio. When we hear a concord, our αἴσθησις is the very same ratio as that of the concord we hear. When we hear a discord, our hearing must still be constituted by the ratio between the two component notes, but they are brought pure and unmixed into the ratio: they are not blended, and hence what we hear is not itself constituted by the relationship between the two. What we actually experience is merely the sum of two percepts, not a product generated by their interaction. Then since they are perceived as separate items, and no mixture is involved which can be perceived in the character of a ratio, and since nevertheless our perception *is* a ratio (ἡ δ' αἴσθησις ὁ λόγος, 426b7), our experience in hearing them cannot correspond to the unimpeded activity of the organ of sense. Its activity, at that time, is the activity of being a ratio: we are unable to experience that activity as such, but can only grasp the elements in the ratio in their separate characters.

This account of Aristotle's argument leaves one important question unresolved, and may also be held to conflict with something that is asserted in the *De Sensu*. These issues are related to one another. The unresolved question is what it is about one kind of combination that allows its elements to be blended, in perception, into a new unity. The doctrine which seems inconsistent with the explanation I have offered is that when two objects of perception do not form a single blended unity, they cannot be perceived simultaneously (*De Sensu* 447b6-21, 448a1-10).⁹ If our perception of them is inevitably successive, not simultaneous, it is not clear that our actualised αἴσθησις should at any of the relevant times be described as being constituted by a ratio.

Aristotle's account of what happens, at least in the case of hearing, when we seem to perceive two items simultaneously but they do not form a single unity, is in fact far from clear. What would he make, for instance, of a case where two discordant and hence unblended notes are prolonged over a substantial period of time? One would suppose that there must be at least some time during the total duration when the two notes are apprehended together, though still in their distinct and unblended characters. At 448a19ff he rejects the obvious suggestion that the notes do not in fact reach us together, but only seem to do so, the intervening lapse of time being so small as to be ἀναίσθητος. Hence he is committed to the view that our reception of the sounds really is simultaneous. The nearest he comes to explaining how and why we nevertheless do not *perceive* them simultaneously is at 448a8-13. 'Nor are things that are mixed perceived together (for they are ratios of things in opposition, like the octave and the fifth),

unless they are perceived as a unity. In those cases there is a single ratio between the extremes: but in other kinds of case there is not, for there will be at the same time the ratio of the many to the few or the odd to the even, and that of the few to the many or the even to the odd.' But this is very unhelpful. In the case of things such as colours, we can see why a pair of uncombined objects will involve two ratios, whereas a blended pair involves only one – and this, I take it, is roughly what Aristotle is saying. If red and blue are ratios between white and black, then a red and a blue colour patch side by side could be grasped simultaneously in perception only by the reception of two different ratios. If they are blended into a single patch of purple, only one ratio remains to be perceived. But in the case of sounds, no comparable argument is available. Of course, *if* the two sounds are perceived unblended, then two distinct objects of perception are involved, though these objects are not (*pace* Hamlyn) themselves ratios: the ratio of the octave or the fifth is not a ratio between ratios, or a ratio made up by blending other ones. But there is no explanation here of why two objects that stand to one another in one kind of ratio form a unity, while those that stand in a different kind of ratio do not. And despite the suggestions of writers like the author of the *Sectio*, there seems to be no systematic distinction between a ratio such as 4:3, which is the ratio of a concord, and one such as 5:4, which, for the Greeks at least, is not.

It is just this sort of distinction which Aristotle needs in his previous discussion of mixtures of colours and of sounds (*De Sensu* 439b25–440a6). There he describes the ratios of concords, and of the pleasanter mixed colours, as εὐλόγιστοι, adding that this is why there are only a few concords; and he goes on to suggest that the inferior colours may be ἄτακτοι and μὴ ἐν ἀριθμοῖς. These remarks will plainly not do as a way of distinguishing concords from discords, at any rate if it is not supplemented with an explanation of what it is that makes the ratio 4:3 εὐλόγιστος and τεταγμένος, while the ratio 5:4 is not. They suggest, perhaps, that Aristotle was aware of the work that had been undertaken by mathematicians and harmonic theorists to try to develop an account of the differences between these classes of ratio, but that he had not studied it closely enough to have discovered that no account even bordering on the satisfactory had in fact been proposed.

Aristotle has, then, no way of distinguishing between our perception of the two kinds of combination of sounds, beyond the harmonic theorist's commonplace that concords are heard as blended unities, while discords are not. It is perhaps less surprising, in view of this deficiency, that he cannot explain what goes on in our αἴσθησις when we simultaneously hear

two sounds that are not blended. It must also be conceded, I think, that his general doctrine alleging the impossibility of perceiving two unblended objects of a single sense simultaneously is thoroughly unconvincing. Could I read yellow writing on a red background if I could not perceive the two colours at the same time? He cannot, in this connection, call upon the powers of the central faculty of perception, as he does in order to explain our simultaneous perception of objects of *different* senses (*De Sensu* 449a10-19), since that depends on the capacity of the central faculty to have qualifications simultaneously in specifically or generically different respects. It cannot apparently, be qualified simultaneously in different ways within a single sensory dimension such as colour or pitch.

The difficulties that I have identified in my interpretation of *De Anima* 426a-b are thus related, first to a question that Aristotle fails to answer, and secondly to a doctrine which in its details seems to have been quite inadequately thought out. If that is the worst that can be said of my suggestions, they may not be altogether wide of the mark. But I should not end this paper without considering briefly the question how the passage, so interpreted, fits into the context in which it is set.

My interpretation was determined, very largely, by the need to get an acceptable thesis out of the opening clause and a valid argument out of the first sentence. I argued that this could only be done if we construed its conclusion as referring only to those cases of actualised hearing whose objects are properly described as ratios, and not to all cases of hearing, or to hearing conceived as a faculty or δύναμις. Since the remainder of the paragraph is linked to the first sentence by the connectives διὰ τοῦτο (426a30) and διό (426b3), this restriction on the scope of the terms αἰσθησις, λόγος, and so on should continue throughout the passage. Aristotle is concerned exclusively with the actualised perception, by a single sense, of a complex object.

This focus of attention is entirely appropriate in the setting in which the passage occurs. The connections between the stages of Aristotle's discussion are not made explicit, but there is a definite progression to be found. 425b26-426a26 discusses actualised perception in general: it is mainly concerned to express the doctrine that the actualisation of perception and of its object are 'in a way' one, to explain what that way is, and to emphasise that the doctrine applies to actual perceivings, not to the capacity of perception, from which actual perceivings are sharply distinguished. After the paragraph we have been discussing, Aristotle raises various difficulties, as in the *De Sensu*, about the simultaneous perception and comparison of objects of different senses (426b8-427a16). According to

my suggestion, the intervening paragraph, again as in the *De Sensu*, adds into the discussion some remarks about the perception of complex objects by a single sense, enunciating the thesis that such cases of perception are ratios, and going on to show how this fact can be used to explain certain familiar truths about complex percepts.

Taken as a whole, then, the discussion begins by stating the proposition that when perception takes place, the act of perception and its object are one. This doctrine may be thought to run into difficulties when the objects of perception are complex, that is, when more than one object is perceived simultaneously. Aristotle therefore addresses himself first to the question how a single sense can perceive a complex object, and shows how his answer can be used to explain certain related facts of experience; and secondly to the question how we can perceive and compare simultaneously the objects of several senses. The progression hangs together tolerably well. It certainly looks more coherent than it does if we suppose that at 426a27 Aristotle has suddenly returned, without signalling the fact, to a discussion of αἴσθησις conceived as a δύναμις, a discussion which, besides being illogically presented, seems to have nothing to do with the issues discussed in the surrounding passages. If we interpreted the passage as being concerned with all *actualised* perception, it would at least share a subject-matter with the arguments that precede it; but its alleged doctrine, that every case of actualised perception is a ratio, seems to contribute nothing to our understanding of the main points at issue. I would therefore claim that my interpretation not only gives a more coherent reading than do its rivals of the passage taken in isolation, but also allows it to be understood much more readily as part of an integrated programme of investigation.

University of Warwick

NOTES

¹ W. D. Ross, *Aristotle, De Anima* (Oxford 1961), 277-8.

² D. W. Hamlyn, *Aristotle's De Anima, Books II and III* (Oxford 1968), 125.

³ Euclid, *Secio Canonis* 149.17-20 (Jan), γινώσκωμεν δὲ καὶ τῶν φθόγγων ... τοὺς μὲν συμφώνους μίαν κράσιν τὴν ἐξ ἁμφοῖν ποιούντας, τοὺς δὲ διαφώνους οὐ. Cf. e.g. Cleonides *Eisagoge* 187.19-188.2 (Jan), Nicomachus *Encheiridion* 262.1-6 (Jan).

⁴ Aristotle has, in fact, spoken with some contempt of people who have failed to observe precisely this distinction, in the sentences immediately preceding the present passage (426a22-26).

⁵ F. Brentano, *The Psychology of Aristotle* (Berkeley 1977), 219 n.64.

⁶ J. I. Beare, *Greek Theories of Elementary Cognition* (Oxford 1906), 126.

⁷ See the passages cited at n.3 above. Nicomachus is perhaps the most explicit: ...

διαφώνοι δέ, όταν διεσχισμένη πως καὶ ἀσύγκρατος ἢ ἐξ ἀμφοτέρων φωνὴ ἀκούηται, 262.5-6 (Jan). Gaudentius shows the other side of the coin: notes are διαφώνοι when μηδεμίαν κραῖσιν πρὸς ἀλλήλους ἐμφαίνωσιν ἅμα προφερομένοι, *Eisagoge* 338.2-3 (Jan).

⁸ The account in the *Sectio* is at 149.11-16 (Jan.) It is very obscure, and I have discussed it in section I of a paper, 'Methods and aims in the Euclidean *Sectio Canonis*', *J. H. S.* 1981. On the challenge made by Plato see my 'Symphonoi arithmoi: a note on *Republic* 531c1-4', *Classical Philology* 73 (1978), 337-342.

⁹ A comparable point is made in the sequel to our present passage, at *De Anima* 426b29 ff. But the discussion there adds nothing, for our purposes, to that of the *De Sensu*, and the latter is in relevant respects rather fuller. I have therefore looked to it, rather than to the *De Anima*, for an account of Aristotle's thought on this matter. Richard Sorabji ('Aristotle, Mathematics and Colour', *C. Q.* n.s. XXII (1972), 300-1) says that the doctrine that is inconsistent with my explanation is not one to which Aristotle himself subscribes, but the conclusion of a plausible argument that he ultimately (449a5ff) treats as erroneous. It would be convenient for me if that were so, but I cannot read the passage in this sense. I see no reason to dissent from Ross's brief account of the structure of *De Sensu* 7, including his contention that on Aristotle's view no one sense can have more than a single object at a time, while 449a5ff explains how objects of several *different* senses may be perceived simultaneously. (See Ross op. cit. p. 228.) This point apart, Sorabji's article should be referred to for a detailed discussion of the 'ratio' theory of colours, and its relation to its counterpart in harmonics.